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E70 Exterior Lighting

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PAGE

Exterior Lighting

Model: E70

Production: From Start of Production

OBJECTIVES

After completion of this module you will be able to:

- Explain the exterior lighting system

Introduction

The exterior lighting in the E70 is based on the exterior lighting system implemented in the E90.

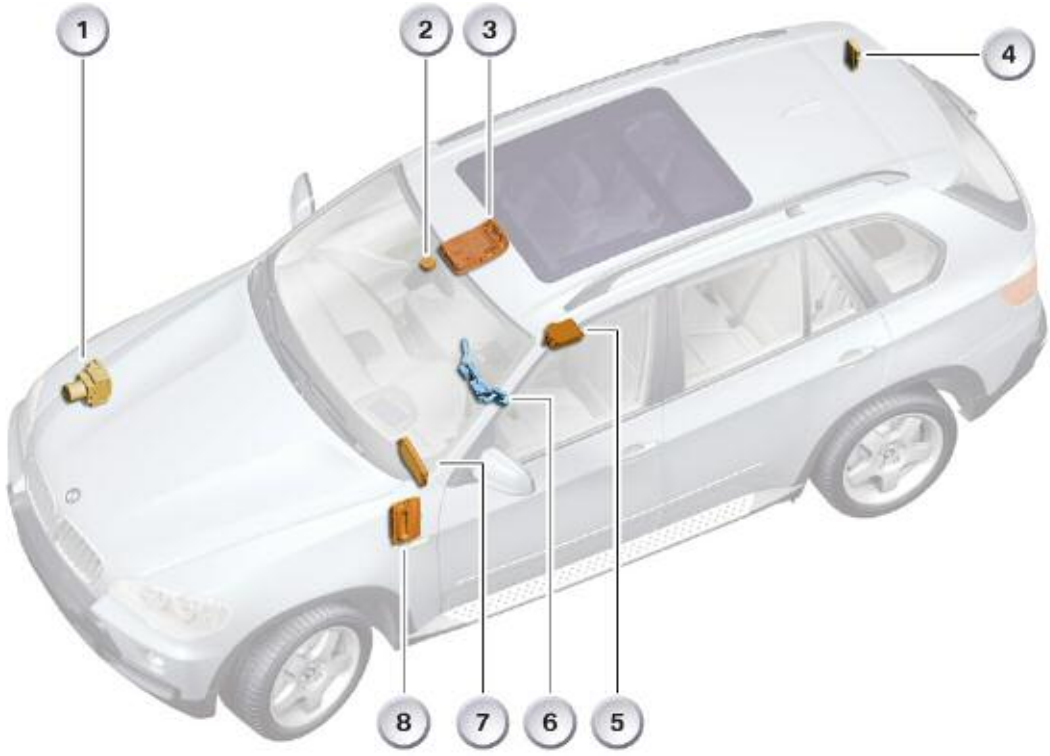
The E70 features the welcome light, making the vehicle even more customer-friendly.

The exterior lighting system is switched on for approximately. 20 seconds when the vehicle is unlocked. This has the advantage of locating the vehicle more easily under unfavorable light conditions.

A further feature is the daytime driving light that can be activated or deactivated via the Personal Profile.

The following graphic shows where the control units responsible for the exterior lighting are located in the E70.

Control Units for the Exterior Lighting



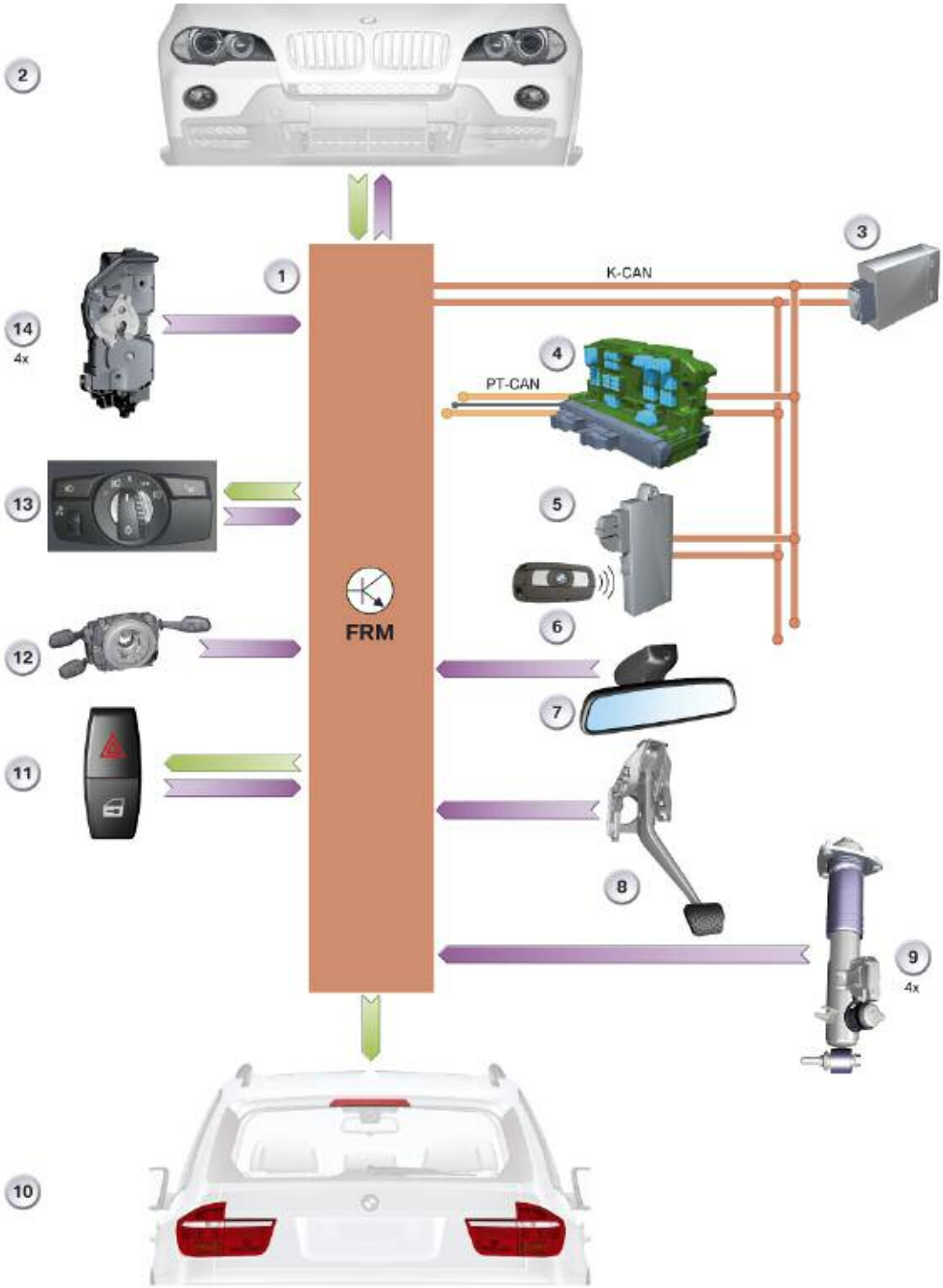
Index	Explanation	Index	Explanation
1	Dynamic stability control	5	Advanced crash safety management
2	Rain/driving lights/solar sensor*	6	Steering column switch cluster
3	Roof functions center	7	Car Access System 3
4	Vertical dynamics management *	8	Footwell module

* Components installed depending on equipment configuration

System Overview

The input/output diagram provides a quick overview of the exterior lighting. It also shows which input or output signals are used for the exterior lighting functions.

IPO - Exterior Lighting

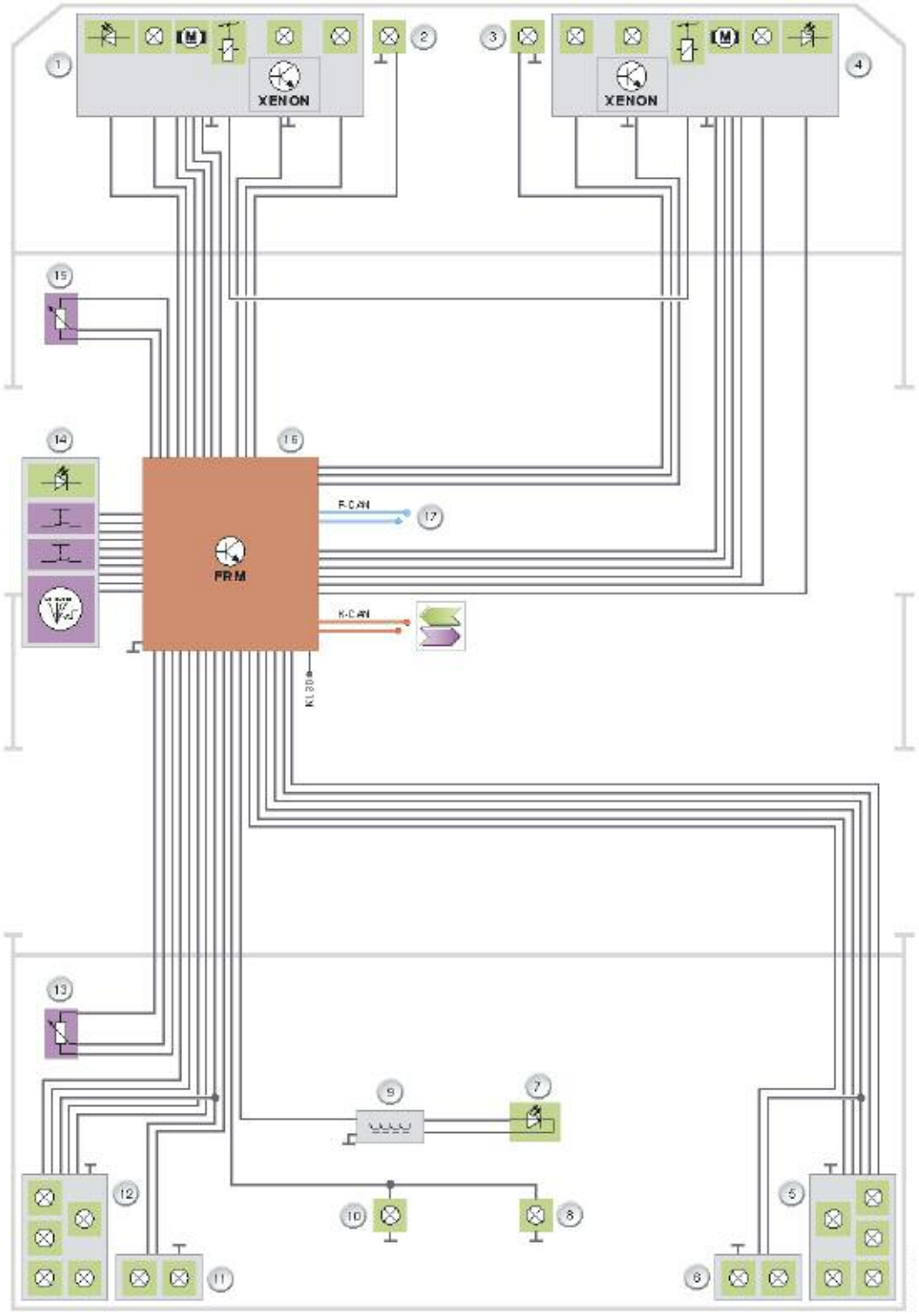


Legend for IPO - Exterior Lighting

Index	Explanation	Index	Explanation
1	Footwell module FRM	9	Sensors, vertical dynamics management
2	Front lighting	10	Rear lighting
3	Trailer module	11	Hazard warning switch
4	Junction box control unit	12	Steering column switch cluster
5	Car Access System 3	13	Lights control panel
6	Identification transmitter	14	Door contact
7	Rain/driving lights/solar sensor in mirror base	PT-CAN	Powertrain CAN
8	Brake light switch BLS	K-CAN	Body CAN

K-CAN signals at the footwell module			
In/out	Information	Source/sink	Function
In	Crash signal	Crash sensor > advanced crash safety management	Interior lighting ON, hazard warning lights ON, terminal 58g ON
In	Status, trailer module	Trailer socket outlet > trailer module	Trailer lighting
Out	Direction indicator	Steering column stalk direction indicator > trailer module	Direction indicator ON

Schematic Circuit Diagram



Legend for Schematic Circuit Diagram

Index	Explanation	Index	Explanation
1	Main headlight, left	11	Rear light cluster, left in tailgate
2	Front fog light, left	12	Tail light, left
3	Front fog light, right	13	Ride-height sensors, rear
4	Main headlight, right	14	Lights control panel
5	Rear light cluster, right	15	Ride-height sensors, front
6	Rear light cluster, right in tailgate	16	Footwell module FRM
7	Raised brake light	17	Signals via F-CAN
8	license plate light, right	F-CAN	Chassis CAN
9	Filter with rejector circuit, raised brake light	K-CAN	Body CAN
10	license plate light, left	KL 30	Terminal 30

K-CAN signals at the footwell module			
In/out	Information	Source/sink	Function
In	Crash signal	Crash sensor > advanced crash safety management	Interior lighting ON, hazard warning lights ON, terminal 58g ON
In	Status, trailer module	Trailer socket outlet > trailer module	Trailer lighting
Out	Direction indicator	Steering column stalk direction indicator > trailer module	Direction indicator ON

F-CAN signals at the footwell module			
In/out	Information	Source/sink	Function
In	Vehicle Ride Height	Sensor, vertical dynamics management > footwell module	Adaptation of headlight range

The range of the headlights is adapted dynamically to the respective vehicle statuses based on the signals from the ride-height sensors. The vehicle statuses include, for example, braking or accelerating as well as various load conditions.

On vehicles equipped with vertical dynamics management, the footwell module receives the ride-height information via the F-CAN.

System Components

The following system components are installed for the exterior lighting:

- Control units
  – The footwell module contains the complete functionality to control and monitor the exterior lighting.
  – Roof functions center with integrated ultrasonic interior protection (motion sensor) Providing signal, e.g. for visual alarm or visual feedback of Anti-theft alarm system
  – Car Access System 3 providing signal, e.g. for visual feedback of central locking system
  – Advanced crash safety management providing signal, e.g. triggered by crash
- Headlights
  – Low beam/high beam headlights
  – Fog lights
- Direction indicator lights
- Direction indicator light repeaters
- Rear light clusters in vehicle body and tailgate
  – Tail light
  – Brake light
  – Rear fog light
  – Reversing light
  – Direction indicator lights
- Lights control panel
- Steering column switch cluster
  – Steering column stalk, high beam/headlight flasher
  – Steering column stalk, direction indicator lights
  – Steering column stalk, wiper with button for automatic driving lights control
- Sensors
- Center-lock button

Bi-Xenon Headlights

Index	Explanation
1	Side Light/Daytime Driving Light
2	Side Light
3	Low bean/high beam/headlight flasher
4	Direction indicator light

Daytime Driving Light

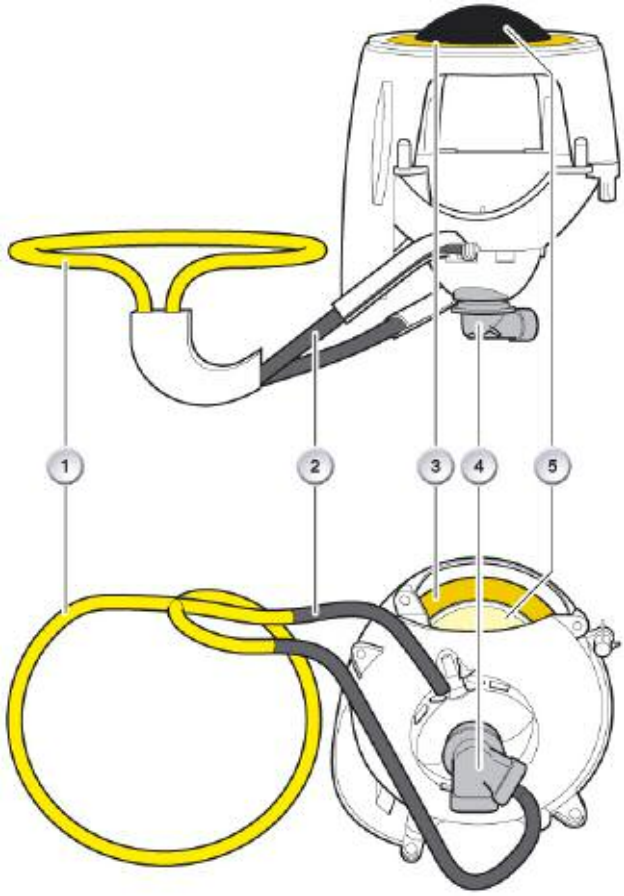
The daytime driving light is produced by the inner and outer corona ring. The inner chamber of the bi-xenon headlight is used for the daytime driving light.

The inner corona ring is illuminated from behind. The reflector is designed to ensure that the light mainly illuminates the corona ring. There is a darkened shutter in the middle of the corona ring that blanks off the forward light from the reflector.

Light from the same headlight chamber is coupled in two fiber optics cables and fed to the outer corona ring.

The outer corona ring functions as a light guide. The inner corona ring is brighter than the outer corona ring in daytime driving lights mode.

The footwell module decreases the daytime driving lights as soon as the side lights or low beam lights are switched on. Consequently, both corona rings of the daytime driving light are now used for the side lights.



Index	Explanation
1	Side Light Ring
2	Light Guide
3	Side Light Ring
4	Bulb
5	Cover

Rear Light Cluster

Design

The rear light cluster of the E70 is based on a split design. One part is integrated in the body and the other in the upper tailgate. The two parts form the complete rear light cluster. The rear light in the body section has four chambers. Almost every chamber, with the exception of the tail light LED, is equipped with a 21 W bulb.

The following chambers are equipped with a 16 W bulb.

- Reversing lights 16 W
- Brake force display 16 W
- Brake light chamber 2

Index	Explanation	Index	Explanation
1	Tail Light	5	Brake Light
2	Brake Light	6	Tail Light
3	Direction Indicator Light	7	Brake Force Display
4	Reversing Light		

The rear light in the tailgate has 2 chambers. One chamber is for the rear fog light while the other chamber is used for the tail light.

The direction indicator light is red. The light cover is also red.

The direction indicator light cover for versions outside the US is light red. The orange color for the direction indicator light is achieved by means of a light filter.

Tail Lights

The tail lights of the E70 are equipped with LEDs. The light from 4 LEDs is routed through fiber optics conductors. The fiber optics conductors distribute the light uniformly.

Side Marker Lights

The US version of the E70 has reflecting side marker lights at the front. They are located in the side apron. The reflective side marker lights at the rear are integrated in the tail light clusters in the US version.

The active side marker lights in the US version is generated by the dimmed front direction indicator lights.

Rear Reflectors

The rear reflectors are located in the bumper.

Lights Control Panel

The lights control panel features following controls as standard:

- Light switch for side lights and low beam
- Manual headlight-range adjustment

The light control panel contains additional controls corresponding to the scope of optional extras.

The additional controls are:

- Automatic driving lights control
- Fog light button
- Head-up display button

Sensors

Ride-Height

One ride-height sensor is mounted on both the front and the rear axle. The signals of the ride-height sensors are used for the headlight-range adjustment LWR. The footwell module directly evaluates the ride-height sensors.

Note: If the vehicle is equipped with vertical dynamics management, the footwell module receives the information for the headlight range adjustment via the F-CAN.

Brake Pedal Switch

The signal of the brake pedal switch is used for the headlight-range adjustment (LWR). The Car Access System 3 supplies the voltage for the brake pedal switch.

Rain/Driving Lights/Solar Sensor

The rain/driving lights/solar sensor provides the signal for switching on the driving lights as from a defined light level.

Principles of Operation

The functions of the exterior light system are integrated in the footwell module.

These lighting functions are:

- Side lights
- Low beam headlight
- High beam
  – Headlight flasher
- Fog light
- Direction indicator light
  – Hazard warning light
- Tail light/license plate light
- Brake light
  – Brake force display
- Reversing light
- Rear fog light (Europe version only)
- Parking light
- Welcome light
- Daytime driving light

With the exception of the raised brake light, the footwell module supplies all light functions with a pulse width-modulated signal. This ensures a constant brightness level of the exterior lighting.

Note: The LEDs (e.g. raised brake light or tail light) the bi-xenon headlight are not controlled but rather activated at 100 % pulse width.

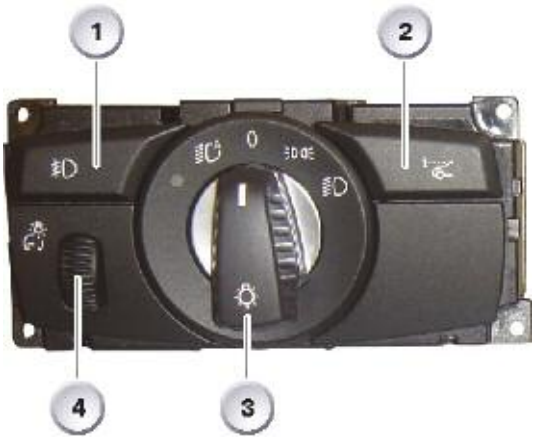
In addition to the standard light functions, further special functions for the exterior lighting are integrated in the footwell module:

- Bi-xenon headlight
- Headlight-range adjustment
- Lamp monitoring
  – Cold monitoring with lights "OFF"
  – Hot monitoring with lights "ON"
- Delayed switch-off home lights
- Daytime driving lights
- Visual alarm
  – Anti-theft alarm system
  – Crash telegram
- Special case at "terminal 15 OFF"
- Emergency operating mode
- Adaptive headlight

Note: The adaptive headlight is described in the Product Information "Adaptive headlights E70". The description of the adaptive headlights includes the turn-off light.

The exterior lighting system is switched on via the light switch.

Example of the lights control panel in the E70



Index	Explanation
1	Fog lights
2	Head-up display button
3	Light switch
4	Dimmer, instrument lighting

Side Lights

The light switch in the light control unit must be turned to switch position 1 to switch on the side lights.

The following lamps are activated together with switching on the side lights:

- Corona rings on halogen headlight
- Daytime driving light corona rings, dimmed on bi-xenon headlight
- Tail lights
- Left/right license plate light
- Terminal 58 switched

Low Beam Headlight

To switch on the low beam headlights, the light switch in the lights control panel must be turned to low beam headlight (switch position 2).

The following lights are activated when the low beam headlights are switched on.

- Bi-xenon lamp on bi-xenon headlamp

After turning off the engine, the side lights stay on although the light switch is in switch position 2. The side lights are switched off automatically as the driver's door is opened.

Note: Leaving the side light switched on can drain the vehicle battery.

High Beam

The high beam headlight is switched on under following conditions:

- Terminal 15 ON and
- Light switch in low beam position and
- Steering column switch for high beam ON

The headlight flasher in connection with halogen headlights is activated by pulling on the steering column stalk. The function is operative as from terminal 30 ON.

Note: The headlight flasher function is now also possible in connection with bi-xenon headlights. The previously separate high beam lamp in the bi-xenon headlamp is therefore no longer required.

Automatic Driving Lights Control

The following conditions must apply for the driving lights (low beam) to be switched on:

- Light switch in automatic driving light control position and
- Status "Terminal 15 ON" and
- Rain/driving lights/solar sensor signals darkness

The footwell module switches on the low beam light if the signal from the rain/driving lights/solar sensor fails due to a defect.

The low beam lights are switched on together with the side lights by the automatic driving lights control system as soon as the rain/driving lights/solar sensor detects a certain level of ambient brightness. The signal is sent from the rain/driving lights/solar sensor via the LIN-bus to the roof functions center.

The roof functions center routes the signal via the K-CAN to the footwell module. In turn, the footwell module evaluates the signal and switches on the driving lights.

The driving lights switched on by the automatic driving lights control system can be switched off with the light switch or by means of the rain/driving lights/solar sensor.

The side lights can also remain on after "Terminal R OFF" because they were switched on by the automatic driving lights control function. The side lights are switched off automatically after opening the driver's door.

If a different door is used to exit the vehicle, the side lights will be switched off when the vehicle is locked.

Note: The rain/driving lights/solar sensor now also contains the solar sensor. It performs the solar sensor function for the air conditioning system. A detailed description of the rain/driving lights/solar sensor can be found in the Product Information "Wiper/Washer System E70".

Fog Light

Switching fog lights ON/OFF

The fog lights can be switched on under following conditions:

- Terminal 15 ON and
- Light switch in side lights or low beam light ON or automatic driving lights control position and
- Fog light button pressed

The fog lights are switched off by pressing the button again. When switched on, the fog lights can also be switched off by turning the light switch to the "Lights OFF" position.

The fog lights can be switched on again when the light switch is set to the side lights, low beam or automatic driving lights control position.

Direction Indicator Lights

The front and rear direction indicator light as well as the side direction indicator repeaters can be switched on as from terminal R ON.

They are operated by means of the switch on the steering column switch cluster. The steering column switch is an optical switch.

An exact description of the steering column stalk can be found in the Product Information "Steering column switch cluster E70".

A defective lamp bulb in the front or rear direction indicator lights causes the remaining direction indicator lights to flash at double the rate.

A defective lamp bulb in the front direction indicator repeaters has no influence on the flashing rate of the direction indicator lights.

The side direction indicator repeaters are equipped with LEDs (Light Emitting Diodes).

The complete direction indicator repeater must be replaced if defective.

One-Touch Indicating

The direction indicator lights are activated three times in connection with one-touch indicating. In the personal profile it is possible to reduce the one-touch indicating function to flash once by way of coding.

Hazard Warning Lights

The hazard warning lights are switched on by pressing the hazard warning switch. As a result, all direction indicator lights are activated simultaneously and the indicator in the hazard warning switch flashes in time.

The steering column switch has priority if it is moved in left or right direction while the hazard warning lights are active. The hazard warning function resumes after terminal R OFF or cancelling the direction indicator.

The hazard warning lights have priority when the direction indicator lights for turning left or right are switched on and the hazard warning switch is pressed.

Index	Explanation
1	Hazard Warning Switch

In Connection with Alarm Triggered

The footwell module receives the request for the hazard warning lights via the K-CAN. The signal is sent by the ultrasonic passenger compartment protection system.

The alarm time for the hazard warning lights is 6 minutes provided the Anti-theft alarm system is not switched off. The hazard warning light switch is blanked out during the alarm and therefore does not flash together with the lights.

Note: The ultrasonic passenger compartment sensor is completely integrated in the roof functions center, both in terms of hardware and software.

Visual and Audible Indicators

The instrument cluster provides visual and audible indication of the turn signals. The footwell module informs the instrument cluster via the K-CAN to activate the acoustic generator and the indicator lights together with the direction indicator lights.

The visual/audible indicator in the instrument cluster switches off if the vehicle is locked with the central locking while the hazard warning light function is active.

Visual Feedback Through the Central Locking

The visual feedback is set at the factory. The direction indicator lights flash when the central locking is activated. The Car Access System 3 makes available the signal necessary for this purpose via the K-CAN.

The visual feedback can be deactivated in the personal profile.

Tail Light/License Plate Light

As from terminal 30, the light switch can be used to switch on the tail lights together with the license plate lights.

The lamp bulbs in the brake light chambers are used as a substitute function for the tail light.

The 21 W lamp bulbs are dimmed by means of a PWM signal for the substitute tail light function.

Brake operation has priority over the substitute function.

Brake Light

As from "Terminal R ON", the brake lights can be switched on by activating the brake light switch.

The Car Access System 3 powers the brake light switch with a 5 V voltage.

Substitute Lighting

The brake force display (two-stage brake light) assumes the substitute function for the outer brake light.

Note: Both chambers are used for the brake light in the US version. No substitute function is provided in the event of the bulb failing.

Brake Force Display

The brake force display is fitted on standard on the E70.

The following conditions must be met for operation of the brake force display:

- Driving speed > 5 km/h
- Brake deceleration above 5 m/s^2
- Control intervention of the antilock braking system

Reversing Light

The reversing light can be switched on as from "Terminal 15 ON". The footwell module receives the signal via the K-CAN. The electronic transmission control unit makes available this signal. On manual transmission vehicles, the footwell module receives the signal from the reverse gear switch.

When the vehicle is in trailer towing mode, the reversing light of the trailer is additionally activated via the trailer module.

Rear Fog Lights

As from "Terminal 15 ON", the button for the rear fog lights can be pressed to switch on the rear fog lights.

The following conditions must apply for this purpose:

- Terminal 15 ON and
- Low beam headlight ON or fog lights ON and
- Button for rear fog lights pressed.

The fog lights are switched off by pressing the button again.

When switched on, the rear fog lights can also be switched off by turning the light switch to the "Lights OFF" position.

Note: The rear fog lights are not switched on in trailer towing mode.

Parking Lights

The parking lights are switched on with the steering column switch as from "Terminal R OFF" and detected by the footwell module via the K-CAN.

For the parking light function, the footwell module activates the front side light and the tail light in the lower chamber of the rear light cluster.

The steering column switch for the parking lights responds with a slight delay when switched. This prevents the parking lights being switched on by mistake, e.g. by knocking against the steering column switch while getting out of the car.

Special Features

Bi-Xenon Headlight

In connection with the bi-xenon headlights, the shutter for the low beam light is activated by the "high beam ON" signal thus enabling the high beam light.

High beam is also used for the headlight flasher function so that the additional halogen headlight (as previously installed) is no longer necessary.

The free chamber in the headlight is used for the daytime driving light. The daytime driving light is produced by the inner and outer corona ring.

Daytime Driving Lights

The light switch must be in position "0" in order to activate the daytime driving lights. If the vehicle is equipped with the automatic driving lights control option, the daytime driving lights are also switched on when the light switch is set to position "A".

The daytime driving lights function is country specific and is activated as from "Terminal 15 ON". The daytime driving lights can be deactivated/activated via the personal profile.

After "Terminal R OFF", the daytime driving lights are only switched off after the driver's door has been opened. If the vehicle is exited through another door, the daytime driving lights are switched off when the vehicle is locked.

Note: The daytime driving lights cannot be deactivated in the personal profile in the US version.

Welcome Light

The light switch must not be in position "0" or "1" in order to activate the welcome light. Furthermore, the parking lights or side lights must also not be activated.The welcome light is switched on as soon as the vehicle is unlocked. For this purpose, the Car Access System 3 makes available the status of the central locking system via the K-CAN.

The footwell module receives the "Unlock vehicle" status and switches on the exterior lighting for approximately. 20 seconds. The ON time can be set to up to 60 seconds via the personal profile. While switched on, the welcome light can be deactivated with the "Terminal R ON" status.

The following light units are activated:

- Tail lights
- Side markers
- Courtesy lighting
- Corona rings
- Interior lighting

Delayed Switch-Off Home Lights

The E70 is equipped with the delayed switch off home lights as standard. The lights can be switched on via the steering column switch for high beam as from lights OFF.

The switch-on time is set at the factory to 40 s and can be set between 0 and 240 s in the "Personal Profile".

The low beam, side lights and tail lights are switched on when the home lights function is active.

Headlight-Range Adjustment

The E70 is equipped with a manual headlight range adjustment system as standard. To comply with legal requirements, a dynamic headlight-range adjustment system is installed in connection with the bi-xenon headlights option. The dynamic headlight range adjustment ensures that the oncoming traffic is not dazzled.

Lamp Monitoring

The footwell monitors all lamps of the exterior lighting system both when switched on and when switched off. The monitoring function starts as from "Terminal 15 ON".

Cold Monitoring

Cold monitoring is based on measuring the current of the individual lamp outputs. The current pulse used for measurement purposes is so short that the lamps are not illuminated. The footwell module evaluates the individual lamp outputs to establish whether there is a line break or a lamp bulb is defective.

The number of current pulses is increased significantly during the first 4 s after "Terminal 15 ON". to check whether the lamps are in working order before setting off. This function is referred to as the pre-drive check.

The number of pulses is then reduced after the pre-drive check. Power is then applied to the lamps every 1.5 minutes.

The raised brake light and tail lights are not included in the cold monitoring function. The LEDs of the brake lights or tail lights react too fast to the current pulse and would consequently light up. This also applies to the rear direction indicator lights as the side direction indicator repeaters are connected together with the rear direction indicator lights.

The bi-xenon headlight is also not included in the cold monitoring. Legal regulations prohibit the current pulse to the bi-xenon headlight.

Hot Monitoring

Hot monitoring is based on measuring the current of the individual lamp outputs. The lamp current is used to detect an overload or interruption (break).

Visual Alarm

Anti-Theft Alarm System

The footwell module enables the Anti-theft alarm system to trigger the visual alarm via the direction indicator lights.

The Anti-theft system receives the signal for the visual alarm via the K-CAN.

A detailed description can be found in the Product Information "Anti-theft Alarm System E70".

Crash Telegram

The footwell module switches on the hazard warning lights and the interior lighting when the advanced crash safety management sends a crash telegram. The hazard warning lights can be switched off with the hazard warning light switch.

The light in the hazard warning light switch is switched off by pressing the light switch to "Lights OFF" position or by means of the rocker switch on the steering column stalk.

Terminal 15 OFF

The exterior lighting is switched off if "Terminal 15 ON" fails during vehicle operation or terminal 15 is inadvertently deactivated by pressing the START-STOP button.

The low beam headlight remains switched on in order to maintain road safety in this situation. When the vehicle speed drops below 20 km/h, the low beam light is also switched off after a delay of approximately 30 seconds.

Emergency Operating Mode

Emergency operating mode is assumed if a defect occurs in the software of the footwell module causing failure of the entire exterior lighting system. In this case, the tail lights and the raised brake light are activated. This function is active as from "Terminal 15 ON".

Service Information

Lights in the Front Area

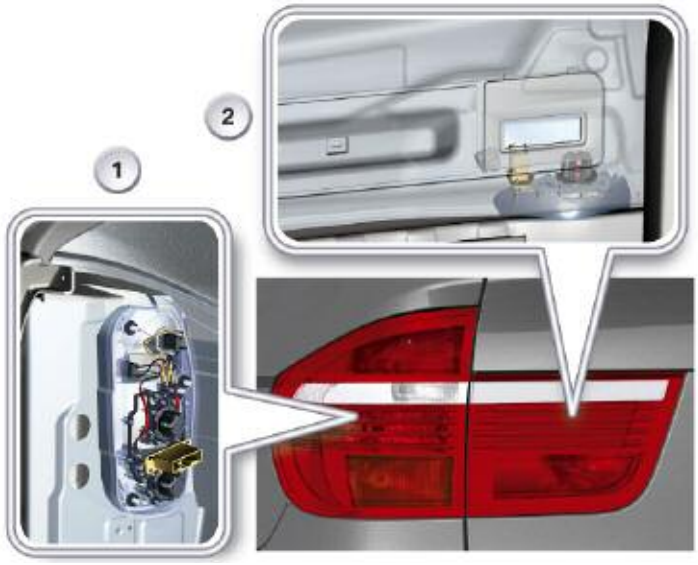
The headlights are accessible through the engine compartment. The headlights are fitted with a service cover. The light source can be replaced after removing the service cover.

The fog lights are accessible from the outside through the ventilation openings. The bulbs for the fog lights can be replaced after removing the ventilation grille.

Lights in the Rear Area

The lights in the rear area are accessible through the opened tailgate. It is necessary to remove the service cover in the trim panel of the tailgate.

The bulbs can then be replaced. The lamps in the body section can be accessed by removing the cover.



Index	Explanation
1	Access from Luggage Compartment
2	Access from Tailgate